EVALUATION OF SOME FEED ADDITIVES AT DIFFERENT LEVELS IN DIET OF NILE TILAPIA (*OREOCHROMIS NILOTICUS*)

ADEL E. TOLAN

Aquaculture Research Unit, Sakha, Central Laboratory of Aquaculture, Abassa, ARC, Egypt

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Abstract

This study was carried out in order to estimate the influence of three levels of dried yeast, two kinds of probiotics (Bacillozyme and Bacillogene) and vitamin C on growth performance, feed utilization, blood parameters, hepatic and renal histopathology, chemical composition of the whole fish and economic feed efficiency of Nile Tilapia (O. niloticus) fingerlings. Total numbers of 390 of Nile Tilapia fingerlings with intial weight of 17.41 gram were divided into four treatment groups and control group. Each treatement group was divided into three sub-groups in three replicates each (39 aquaria). Each aquarium were contained 10 fish. Different types of additives were added to abasal diet (22% CP) at three levels each including dried yeast (10, 15 and 20 g/kg diet); probiotics (Bacillozym and Bacillogene), 1, 2 and 3 g/kg diet from each probiotic and vitamin C (500, 1500 and 2000 mg/kg diet. The best growth performance and feed utilization without any pathological signs in liver and kidney, normal blood parameters and chemical composition of meat and the best economic efficiency were obtained with bacillozyme at level three grams/kg diet. Dried yeast at level of 20 g/kg diet showed significantly better results than the control group. The lowest results were obtained with the highest level of vitamin c (2000 ppm/kg).

Keywords: Fish, growth performance, niltoicus, probiotics, vitamine C, growth performance, blood.

INTRODUCTION

In Egypt, fish culture became widely supported to help in providing addition of animal protein resources. The most popular kind of fish raised in Egypt is *Oreochromis niloticus*. Intensive culturing of fish needs formulated ration of high quality, which represent 50% of production cost (Collins and Delmendo, 1979) which is the main target of nutritionist to minimize the cost of feed.

Feed additives including probiotics, antibiotics, vitamins and dried yeast were used to maximize utilization of ration ingredient by fish. Antibiotics had some seriously adverse effects as multiple drug resistant and residual in animal products (Wary and Davis, 2000), while vitamins such as vit. C is natural antioxidant nutrient that play an important role in animal health by inactivating harmful free radicals (McDowell, 1989).

Using natural food additives to substitute antibiotic became essential request (Kumar *et al.*, 2003). Therefore, the present study was carried out to determine the effects of different supplementation levels of some commercial probiotics (Bacillozyme and bacillogene zinc), vitamin C and dried yeast on growth performance, feed utilization, blood parameters and economic efficiency of *Oreochromis niloticus* fish.

MATERIALS AND METHODS

The present study was carried out at Fish Laboratory, Animal Production Department, Faculty of Agriculture, Kafer El-Sheikh University during the period from July to August 2006.

Fish and management:

A total number of 390 healthy *(O. niloticus)* fingerlings were purchased from Al-Manzalah Integrated Fish Farm, General Authority for Fisheries Resources Development, with an average initial body weight of about 17 g. Fish were randomly distributed into 13 treatments groups, each treatment was presented in three replicates. In each replicate 10 fingerlings were stocked in a glass aquarium (80 x 32 x 40 cm) containing about 102 liters of dechlorinated tap water and an air-stone concreted with an electric compressor. The aquaria water was partially replaced every day to renew the water. Electric light was used to complete the daylight to 14 hours.

Feeding system and feed additives:

The experimental fish were fed the tested diets twice daily at 9 a.m. and 3 p.m., six days/week for an experimental feeding period of 35 days. The daily feeding rate was 3% (on DM basis) of live body weight of the fish and the feed amount was adjusted biweekly on the basis of the actual average biomass of the fish within each replicate.

A ground basal diet was over fed to fish in all treatments at the same times. Proximate fed to satiation analysis of the basal diet is presented in Table (1).

Table 1. Proximate analysis of the basal diet fed to fish in all treatments.

Ingredient	%	Ingredient	%
Dry matter	93	Ash	8.11
Crude protein	22	NFE	5.22
Ether extract	16	Gross energy	5200
Crude fiber	3.0	Energy/Protein ratio	236.36

Dried yeast, probiotic bacillozym containing bacillus subtilus, $0.75x10^{10}$; cellulose enzyme, 15000; protease, 187500; alfa- amylaze, 300.000; beta-amylaze and saccaromyces services, $200x10^{10}$ (IBEX pharmaceutical), the tested probiotic Bacillogene zinc contained 500 g bacillus subtilus garlic allicine, 0.247 micromil and hydrolytic enzyme plus zinc methionine (IBEX pharmaceutical) and vitamin C (ADWIA pharmaceutical) were used as feed additives as a rates .Beside the basal diet fed to the control treatment, four feed additives including dried yeast, Bacillozyme, Bacillogene zinc and vitamin C, three levels of each, were added to the basal diet as shown in Table (2).

Table 2. Experimental treatment groups with different levels of feed additives fed to *O. niloticus* fish.

Feed additive	Treatment	Level of supplementation /kg basal diet
Without	Control	Basal diet without
Dried yeast	DY1	10 g
	DY2	15 g
	DY3	20 g
Bacillozym	BZ1	1 g
	BZ2	2 g
	BZ3	3 g
Bacillogene zinc	BG1	1 g
	BG2	2 g
	BG3	3 g
Vitamin C	VC1	500 mg
	VC2	1500 mg
	VC3	2000 mg

Experimental procedures:

Live body weight and feed intake of fish was weekly recorded, also initial and final live body weight as well as average total and daily gain, specific growth rate, feed conversion ratio and protein efficiency ratio were calculated. Survival rate was recorded, and all previous traits were calculated according to the following equations:

Total weight gain (g) = $Wt_1 - Wt_0$

Where:

Wt_1 is the final body weight (g) and Wt_0 is the initial body weight (g).

Average daily gain (g) = $Wt_1 - Wt_0 / T$

Where:

T is the experimental period (day), Wt_0 is the initial body weight (g) and Wt_1 is the final body weight (g) according to Castell and Tiews (1980).

Specific growth rate (%/d) = $(\text{Ln } Wt_1 - \text{Ln } Wt_0 / T) \times 100$

Where:

Ln is the natural logarithm of final and initial weight, respectively, and T is the experimental period (day) according to Pouomogne and Mbongblang (1993).

Feed conversion ratio=feed intake (g)/weight gain (g) (Tacon, 1987)

Protein efficiency ratio = (TWG (g)/TPI (g)) x 100

Where:

TWG is total weight gain and TPI is total protein intake according to (Davis and

Morries, 1997)

Survival rate = (No. of fish at end/ No. of fish at start) x 100

At the end of the experiment, 6 fish from each treatment, 2 fish from each replicate were randomly taken for chemical analysis of the whole body.

Analytical procedures and blood samples:

The chemical analysis of the basal diet and the whole fish body at the end of experiment were carried out using the methods of A.O.A.C. (1990).

Blood samples were collected at the end of experiment from 6 fish of each treatment, two fish from each replicate. In blood serum of fish, concentrations of total protein (Merck, 1974) and albumin (Doumas *et al.,* 1971) were measured by colorimetric methods using commercial kits and spectrophotometer. However, concentration of globulin was determined by substracting concentration of total protein from albumin concentration.

Activity of liver enzymes, Aspartate amino transaminase (AST) and Alanine amino transaminase (ALT) was determined using commercial kits (Biomerieux) and spectrophotometer according to (Reitman and Frankel, 1957).

Histological study:

At the end of experiment, specimens from kidney and liver of three fish in each group were immediately fixed in buffered 10% neutral formalin. After a fixation period of 24-48 hours, all specimens were processed for routine paraffin technique. Paraffin sections (8-10 µm) were stained by Harris Haematoxyline and Eosin according to Drury and Wallington (1980). Thereafter, slides were examined for histopathological signs.

Statistical analysis:

The obtained data were analyzed by F-test according to Sendecor and Cochran (1982) using SAS (1996) procedure for personal computer. Least significant difference according to Duncan (1955) was used for the comparison among the significant group means at level of $P<0.05$.

RESULTS AND DISCUSSION

Growth performance:

Data presented in Table (3) show significant ($P<0.05$) effects of dietary additives on final body weight, total weight gain, average daily gain and specific growth rate of fish in different treatment groups.

Among all dietary additives, fish in BG3 group showed significantly ($P<0.05$) the heaviest final weight (26.89 g), and the highest total gain (9.39 g), average daily gain (0.27 g) and specific growth rate (0.43 %/d). However, fish in VC3 group showed

significantly ($P<0.05$) the lowest values, being 20.93 g, 3.49 g, 0.10 g and 0.18 %/d, respectively (Table 3).

It is of interest to note that fish fed all levels of dried yeast (DY1, DY2 and DY3 groups) and those in BZ3 group showed significantly ($P<0.05$) higher values of final weight, total gain, average daily gain and specific growth rate than the control group and did not differ significantly than those in BG3. However, fish fed the low and medium levels in BZ1, BZ, BG1, BG2, VC1 and VC2 did not differ significantly than the control group in most growth traits studied (Table 3).

A participant observation could be noticed among the tested dietary additives that the all levels of dried yeast achieved significantly higher growth of tilapia fish, being the highest for a level of 15 g/kg diet. However, growth of fish increased by increasing level of Bacillogene zinc or Bacillozyme from 1 to 3 g /kg diet. Yet, levels of 500 and 1500-ppm vitamin C failed to achieve the expected growth; even growth was delayed when its level increased to 2000 mg in diet of tilapia fish.

On the basis of the obtained results, fish fed diet supplemented with Bacillozyme zinc at a level of 3 g/kg showed beneficial effects on their growth performance.

The beneficial effects of probiotics (Lacto-Sacc) on growth performance, gain and feed efficiency of rabbits have been reported by several; authors (El-Hindawy *et al.* 1993, 1994 & 1997 and Yamani *et al.*, 1992). The present results concerning growth performance traits are in agreement with those obtained by Abdelhamed *et al.* (2000) and Magouz *et al.* (2002) on Nile tilapia fingerlings fed on diets supplemented with dried yeast and Lacto-Sacc as probiotics. The beneficial effects of probiotics may be mediated by a direct antagonistic effect against specific groups of microorganisms, resulting in suppression of viable count, suppression of bacterial number, an alteration of microbial metabolism or by stimulation of immunity (Fuller, 1989 and Sissons, 1989). Also, the improvement in growth and gain of fish in BZ and BG groups may be related to a change in enteric flora and reduction of E. coli decreasing in the intestinal pH, production of antibiotic substances and/or reducing the toxic amines and ammonia level in the gut and blood of fish (Pollman, 1986).

It is of interest to note that higher increase in total gain of fish was observed with increasing level of DY, BZ and BG supplementation. However, the opposite was noticed with increasing VC level.

Table 3. Growth performance parameters of *O. niloticus* fish as affected by dietary additives in treatment groups.

Treatment group	Initial weight (g)	Final weight (g)	Total gain (g)	Average daily gain (g/fish/day)	Specific growth rate (%/d)
Control	17.41	23.00±0.10^{b}	5.59±0.02^{d}	0.16±0.001^{c}	0.27^{c}
DY1	17.41.	25.90±0.15^{a}	8.49±0.03^{b}	0.24±0.001^{a}	0.40^{a}
DY2	17.41	26.33±0.01^{a}	8.92±0.01^{b}	0.25±0.001^{a}	0.41^{a}
DY3	17.41	26.42±0.02^{a}	9.01±0.01^{a}	0.26±0.010^{a}	0.43^{a}
BZ1	17.41	23.00±0.31^{b}	5.59±0.04^{d}	0.16±0.002^{c}	0.35^{b}
BZ2	17.41	23.40±0.30^{b}	5.99±0.05^{d}	0.17±0.001^{c}	0.29^{c}
BZ3	17.41	25.52±0.02^{a}	8.11±0.11^{b}	0.23±0.010^{b}	0.39^{a}
BG1	17.41	23.80±0.13^{b}	6.39±0.03^{c}	0.18±0.003^{c}	0.31^{b}
BG2	17.41	24.50±1.10^{b}	7.09±0.07^{c}	0.21±0.003^{b}	0.34^{b}
BG3	17.41	26.80±1.30^{a}	9.39±0.11^{a}	0.27±0.011^{a}	0.43^{a}
VC1	17.41	24.80±0.17^{b}	7.39±0.05^{c}	0.21±0.013^{b}	0.35^{b}
VC2	17.41	23.78±0.13^{b}	6.37±0.03^{c}	0.18±0.014^{c}	0.31^{b}
VC3	17.41	20.90±1.10^{c}	3.49±0.01^{e}	0.10±0.001^{d}	0.18^{c}

Group with different superscripts within the same column are significantly different at P<0.05.

In this respect, Magouz *et al.* (2002) found similar trend by using Lacto-Sacc, Fermato and Bio-tonic as probiotics, whereas increasing level of supplementation from 1 up to 4 g of these probiotics//kg diet resulted in rather improvement in gain of Nile tilapia. Such trend reversed that reported on rabbit, being more benefit at 1 g/kg diet (Tawfeek and El-Hindawy, 1991). This was proved in the present study by increasing total gain of fish by increasing level of DY supplementation from 1 up to 3g/kg diet, which may indicated that fish require higher level to achieved the highest growth performance.

Concerning the negative trend of increasing level of VC on growth performance parameters in all VC groups may suggest a toxic effect of VC at high levels. It was stated that with dietary ascorbic acid 200 mg/kg diet, weight gain was improved in channel catfish (Duncan and Lovell (1994) and Nile tilapia (Abd Elaziz and Mahmoud, 2004).

Feed utilization and survival rate:

Results shown in Table (4) revealed significant (P<0.05) effect of dietary additives on feed intake, feed conversion ratio, protein efficiency ratio and survival rate of fish in different treatment groups.

In comparison among treatment groups, fish fed DY3 and VC1 diets showed significantly ($P<0.05$) higher feed intake than the other treatment groups and the control group. However, fish in BG3 showed significantly ($P<0.05$) the lowest feed intake (Table 4).

Table 4. Feed intake and feed utilization of O. niloticus fish as affected by different dietary additives.

Treatment group	Feed intake (g)	Total gain (g)	Feed conversion ratio	Protein efficiency ratio	Survival rate (%)
Control	21.70^{b}	5.59 ± 0.02^{d}	3.88^{b}	1.37^{b}	100^{a}
DY1	23.28^{ab}	8.49 ± 0.03^{b}	2.74^{c}	1.66^{a}	100^{a}
DY2	22.20^{b}	8.92 ± 0.01^{b}	2.48^{c}	1.80^{a}	90^{b}
DY3	26.01^{a}	9.01 ± 0.01^{a}	2.88^{bc}	1.58^{a}	100^{a}
BZ1	21.70^{b}	5.59 ± 0.04^{d}	3.88^{b}	1.17^{c}	100^{a}
BZ2	21.60^{b}	5.99 ± 0.05^{d}	3.61^{b}	1.26^{bc}	100^{a}
BZ3	22.40^{b}	8.11 ± 0.11^{b}	2.76^{c}	1.65^{a}	100^{a}
BG1	23.45^{b}	6.39 ± 0.03^{c}	3.67^{b}	1.23^{c}	90^{b}
BG2	22.58^{b}	7.09 ± 0.07^{c}	3.18^{b}	1.43^{b}	90^{b}
BG3	21.50^{b}	9.39 ± 0.11^{a}	2.29^{c}	1.74^{a}	100^{a}
VC1	24.54^{a}	7.39 ± 0.05^{c}	3.32^{bc}	1.37^{b}	90^{b}
VC2	22.02^{b}	6.37 ± 0.03^{c}	3.46^{b}	1.32^{b}	100^{a}
VC3	22.38^{b}	3.49 ± 0.01^{e}	6.41^{a}	0.71^{c}	90^{b}

Group with different superscripts within the same column are significantly different at $P<0.05$.

The highest total gain along with the lowest feed intake of fish in BG3 was reflected in the best feed conversion ratio and protein efficiency ratio as compared to the other treatment groups and control group. Meanwhile, fish VC3 showed the lowest values, being in an opposite manner (Table 4).

Values of protein efficiency ratio were significantly ($P<0.05$) different, was higher in all DY groups, as well as the highest level of BZ and BG groups. While, it significantly ($P<0.05$) decreased with the low level of BZ and BG as well as the highest level of VC groups (Table 4).

Concerning the survival rate, no mortality cases were recorded in DY1, DY3, all BZ groups, BG3 and VC2. However, survival rate was 90% in the other groups.

Based on the present results, supplementation of 3 g from BG/kg to diets of Nile Tilapia had beneficial effects on feed utilization and survival rate of fish. Similar results were recorded on Nile tilapia using Lacto-Sacc, Fermacto and Bio-tonic as feed additives (Magouz *et al.*, 2002) or dried yeast and Lacto-Sacc as dietary supplementation (Abdelhamed *et al.*, 2000).

Blood parameters:

Results shown in Table (5) revealed significant (P<0.05) effect of dietary additives on concentration of total protein, albumin (AL), globulin (GL), AL/GL ratio, urea and creatinin as well as activity of transaminases (AST &ALT) in blood serum of tilapia fish at the end of experiment.

As compared to the control group, albumen concentration significantly (P<0.05) decreased in all DY, BG and VC groups, being the lowest in VC3. Concentration of globulin significantly (P<0.05) increased in all BZ groups and DY2 and DY3 groups, and significantly (P<0.05) decreased in all VC groups and BG1 and BG2 groups. This is reflected in significant (P<0.05) decrease in concentration of total protein in BG1 and BG2 groups as well as all VC groups. Also, albumin/globulin ratio significantly (P<0.05) increased in BZ and BZ3, and significantly (P<0.05) decreased in DY2, DY3, BG2 and BG3 (Table 5).

Table 5. Concentration of total proteins and their fractions in blood serum of *O. niloticus* fish as affected by dietary additives in treatment groups.

Treatment group	Albumin (AL, g/dl)	Globulin (GL, g/dl)	Total protein (g/dl)	AL/GL ratio
Control	2.50^{a}	1.09^{b}	3.40^{ab}	2.30^{b}
DY1	2.13^{b}	1.02^{b}	3.15^{ab}	2.10^{b}
DY2	2.15^{b}	1.25^{a}	3.40^{ab}	1.72^{c}
DY3	2.17^{b}	1.24^{a}	3.31^{ab}	1.74^{c}
BZ1	3.17^{a}	1.28^{a}	4.45^{a}	2.48^{b}
BZ2	3.00^{a}	1.30^{a}	4.30^{a}	3.00^{a}
BZ3	2.90^{a}	1.50^{a}	3.90^{a}	2.90^{a}
BG1	1.00^{c}	0.44^{c}	1.44^{c}	2.27^{b}
BG2	1.02^{c}	0.64^{c}	1.66^{c}	1.60^{c}
BG3	1.26^{c}	1.13^{ab}	2.39^{b}	1.11^{c}
VC1	1.06^{c}	0.47^{c}	1.51^{c}	2.30^{b}
VC2	1.04^{c}	0.45^{c}	1.49^{c}	2.30^{b}
VC3	1.00^{c}	0.35^{d}	1.35^{c}	2.90^{a}

Group with different superscripts within the same column are significantly different at P<0.05.

Concentration of urea significantly (P<0.05) increased in all DY groups and BZ1 and BZ2. While, concentration of creatinin significantly (P<0.05) increased in all DY, BZ and BG groups, being the highest in all BZ groups. On the other hand, activity of AST significantly (P<0.05) increased in all DY and BZ groups, and activity of ALT significantly (P<0.05) increased in all BG and BZ groups. (Table 6). In general, fish of VC3 group showed significantly (P<0.05) the lowest albumin, globulin and total

protein concentrations, while those in BZ1 showed significantly (P<0.05) the highest concentration of urea and creatinin and the highest activity of AST and ALT (Table 6).

The information on the effect of probiotics used in this study on blood parameters of fish are scare. In agreement with the present results concerning the changes in ALT activity in fish fed DY, Ragheb *et al.* (2003) found that the effect of Lacto-Sacc on concentration of total protein was insignificant, while concentration of urea in blood plasma of growing calves significantly increased in supplemented than the control calves.

Table 6. Concentration of urea and creatinin and activity of transaminases (AST &ALT) in blood serum of *O. niloticus* fish as affected by dietary additives in treatment groups.

Treatment group	Blood parameter		Enzyme activity	
	Urea (mg/dl)	Creatinin (mg/dl)	AST (IU/dl)	ALT (IU/dl)
Control	14^{c}	0.10^{c}	112^{b}	15^{b}
DY1	23^{b}	0.24^{b}	116^{a}	16^{b}
DY2	19^{b}	0.20^{b}	114^{a}	15^{b}
DY3	15^{b}	2.19^{b}	114^{a}	15^{b}
BZ1	30^{a}	0.66^{a}	116^{a}	26^{a}
BZ2	22^{b}	0.51^{a}	115^{a}	23^{a}
BZ3	10^{c}	0.45^{a}	114^{a}	21^{a}
BG1	13^{c}	0.32^{ab}	110^{b}	24^{a}
BG2	15^{c}	0.31^{ab}	110^{b}	25^{a}
BG3	14^{c}	0.19^{ab}	112^{b}	26^{a}
VC1	11^{c}	0.08^{c}	112^{b}	14^{b}
VC2	10^{c}	0.08^{c}	111^{b}	13^{b}
VC3	12^{c}	0.09^{c}	112^{b}	14^{b}

Group with different superscripts within the same column are significantly different at P<0.05.

Chemical composition and energy content:

Data in table (7) revealed that as compared to the control group, moisture content significantly (P<0.05) decreased in fish of all DY groups, the highest level of BZ and BG groups and the lowest level of VC group.

Content of CP significantly (P<0.05) decreased in all BZ and VC groups and the lower levels of DY and BG groups. However, contents of EE significantly (P<) increased in all treated groups, being the highest in DY1 group. Also, content of ash significantly (P<0.05) increased in all DY groups, BZ2 and BG1, and significantly (P<0.05) decreased, being the lowest in VC2 and VC3 groups (Table 7).

Table 7. Carcass chemical composition and energy content of *O. niloticus* fish as affected by additives in treatment groups.

Treat. group	Moisture (%)	Chemical composition (%)			GE (kcol/kg)
		CP	EE	Ash	
Control	77.7±1.1^{a}	50.2±1.10^{a}	16.9±0.11^{d}	7.30±0.01^{b}	4822.2±0.7^{d}
DY1	74.1±1.20^{b}	49.8±1.30^{b}	30.22±0.15^{a}	8.22±0.07^{a}	5510.7±0.11^{b}
DY2	75.3±1.10^{b}	50.4±1.30^{a}	29.13±0.16^{b}	8.11±1.03^{a}	5543.8±1.24^{b}
DY3	71.1±0.01^{c}	53.3±0.92^{a}	30.30±0.00^{a}	9.30±2.20^{a}	5720.2±1.20^{a}
BZ1	76.0±0.13^{a}	45.8±1.01^{b}	29.41±0.40^{b}	7.70±0.11^{b}	5612.3±0.21^{a}
BZ2	77.0±0.13^{a}	45.3±1.02^{b}	29.37±0.15^{b}	8.20±0.33^{a}	5677.0±0.30^{a}
BZ3	75.2±0.12^{b}	49.1±0.92^{b}	27.33±0.17^{b}	7.20±0.32^{b}	5522.3±1.05^{c}
BG1	76.9±0.11^{ab}	46.8±0.88^{b}	28.21±0.11^{b}	8.66±0.31^{a}	5455.2±1.13^{c}
BG2	76.4±0.11^{ab}	47.9±0.01^{b}	25.33±0.11^{c}	7.65±0.33^{b}	5511.3±1.70^{c}
BG3	73.2±0.13^{c}	54.7±0.09^{a}	24.41±0.30^{c}	7.40±0.51^{b}	5422.7±1.20^{d}
VC1	73.9±0.18^{c}	48.1±1.10^{b}	23.47±0.33^{c}	7.50±0.50^{b}	4999.9±2.10^{d}
VC2	77.1±0.18^{a}	44.2±0.30^{c}	23.21±0.10^{c}	6.20±0.03^{c}	4822.8±1.01^{d}
VC3	78.9±0.00^{a}	42.1±0.00^{c}	20.10±0.10^{c}	6.10±0.00^{c}	4800.3±1.30^{d}

Group with different superscripts within the same column are significantly different at P<0.05.

On the other hand, gross energy contents were significantly (P<0.05) increased in all DY and BZ groups, and significantly decreased in BG1 and BG2 groups (Table 7).

In general, fish in DY3 group showed significantly (P<0.05) the lowest moisture content and the highest CP, EE, ash and energy contents. Similar trend of change in DM, CP EE and ash in body of fish fed DY were obtained by Magouz *et al.* (2002) in Nile tilapia fish fed diet supplemented with Lacto-Sacc. Generally, boy composition of fish in all groups is within the range reported by Abdelhamed *et al.* (2000)

Histopathological signs:

The histological examination of kidney and liver of fish in different treatment groups revealed normal histological structure of these organs, except signs of harmful in kidney of VC3 group showing abnormal architecture of the renal cortex and congestion of glomerulosa and leading to nephritis (Figs. 1 and 2). In liver of fish in VC3 group, only abnormal hepatic lobules and lymphatic nodules were seen between the hepatocytes (Fig. 3). Kidney of fish in DY1, DY2 and DY3 groups showed normal architecture of the renal cortex and intact structure of both glomerulosa and renal tubules (Figs. 4, 5 and 6).

However, liver of fish in all DY groups showed normal architecture of the hepatic lobules, central vein and hepatocytes, but small vacuoles were found within the portal lobules (Fig. 7). In liver of fish in BZ group, normal architecture of the hepatic lobules,

but the central vein was branched and wide sinusoid as well as lymphatic population within the hepatic lobules and the portal lobules (Figs. 8 & 9).

Liver of fish in DY3 showed normal architecture of the hepatic lobules, some vacuoles within the hepatic lobules (Fig. 10). On the other hand, kidney of fish in BG group showed normal architecture of the renal cortex and intact structure of both glomerulosa and renal tubules, but mild infiltration of fibroblast cells was observed between the renal tubules (Fig. 11).

Economic feed efficiency:

In comparing price of each ton of feed used different treatment groups, BG3 group had the highest price and the control feed showed the lowest price. Such trend was associated with the highest price of each gram and high level of supplementation from Bacillozyme as compared to the other supplements (Table 8).

Based on feed cost per kg gain, fish in DY3, BZ3, BG3 and VC1 showed significantly (P<) lower feed price to produce one kg gain in weight as compared to the control group. This was mainly attributed to the higher total gain of fish in spite of the higher price of feed (Table 8).

Generally, fish in BG3 group showed the highest total gain and the lowest feed cost per kg gain, leading to the best economic feed efficiency (Table 7).

Table 8. Economic feed efficiency of *O. niloticus* fish as affected by dietary additives in treatment groups.

Treatment group	Feed intake (g)	Price of each ton feed (L.E.)	Total gain (g)	Feed cost/kg gain (L.E.)
Control	21.70	1600	5.59	6.21^{b}
DY1	23.28	1760	8.49	4.83^{d}
DY2	22.20	1840	8.92	4.58^{d}
DY3	26.01	1920	9.01	5.54
BZ1	21.70	1712	5.59	6.65^{b}
BZ2	21.60	1824	5.99	6.50^{b}
BZ3	22.40	1936	8.11	5.35^{c}
BG1	23.45	1750	6.39	6.42^{b}
BG2	22.58	1900	7.09	6.05^{b}
BG3	21.50	2050	9.39	5.35^{c}
VC1	24.54	1615	7.39	5.36^{c}
VC2	22.02	1645	6.37	5.69^{c}
VC3	22.38	1660	3.49	10.6^{a}

Group with different superscripts within the same column are significantly different at P<0.05.

According to local market price, 2005, price was 1600 L.E. for each ton basal diet, 16 L.E. for each kg-dried yeast, 28 LE. For 250 g Bacillozyme, L.E. for 200 g Bacillogene and 15 L.E. for 500 g vit. C.

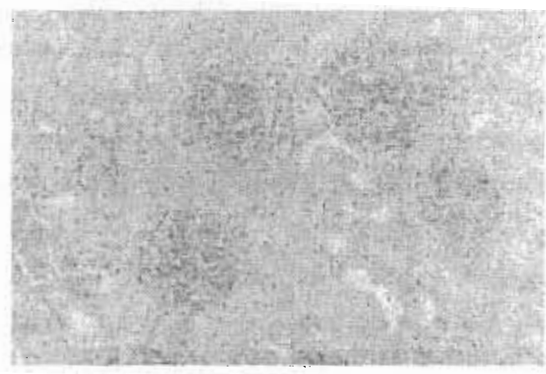

Fig. 1. Section in kidney of fish in VC3 group showing abnormal architecture of the renal cortex and congestion of glomerulosa and leading to nephritis (x 150, H&E stains).

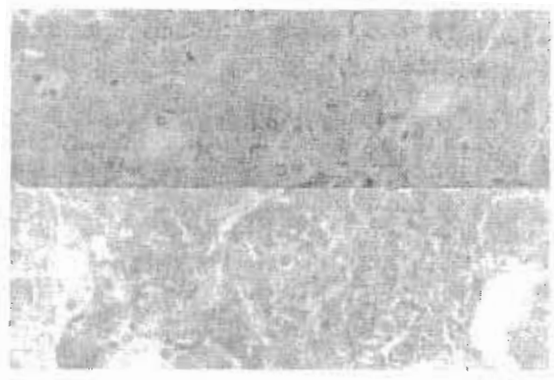

Fig. 2. Magnification of the previous section in kidney of fish in VC3 group showing sever congestion in glomerulosa. (x 250, H&E stains)

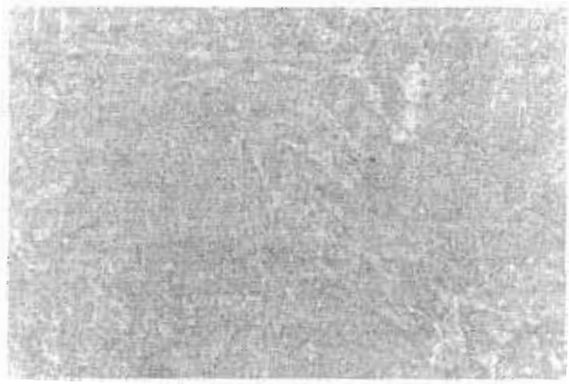

Fig. 3. Section in liver of fish in VC3 group showing abnormal hepatic lobules and lymphatic nodules were seen between the hepatocytes. (x 250, H&E stains).

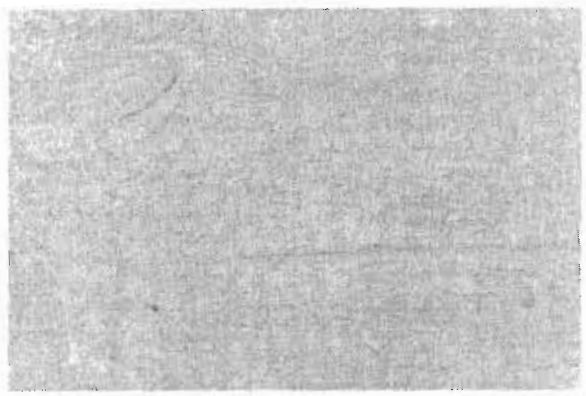

Fig. 4. Section in kidney of fish in DY1 group showing normal architecture of the renal cortex and intact structure of both glomerulosa and renal tubules. (x 120, H&E stains)

Fig. 5. Section in kidney of fish in DY2 group showing normal architecture of the renal cortex and intact structure of both glomerulosa and renal tubules. (x 120, H&E stains)

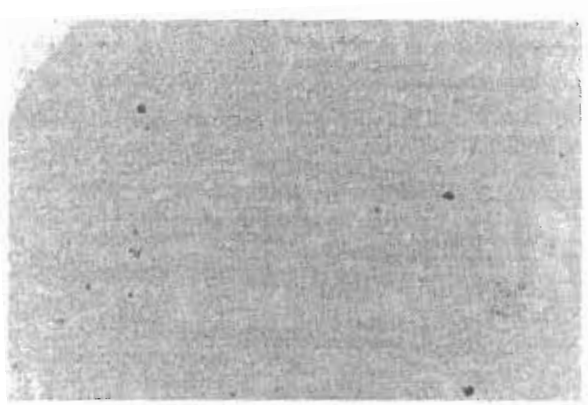

Fig. 6. Section in kidney of fish in DY3 group showing normal architecture of the renal cortex and intact structure of both glomerulosa and renal tubules. (x 120, H&E stains)

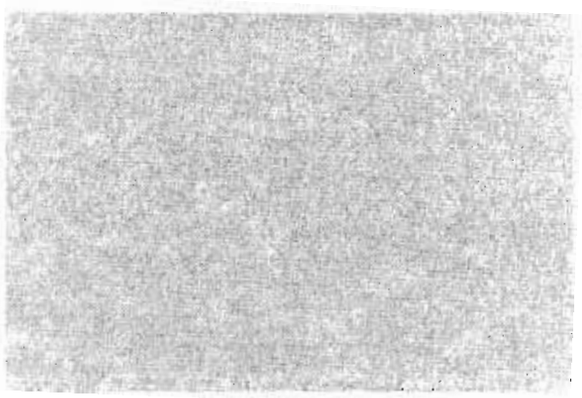

Fig. 7. Section in liver of fish in DY showing normal architecture of the hepatic lobules, central vein and hepatocytes, but small vacuoles were found within the portal lobules. (x 120, H&E stains)

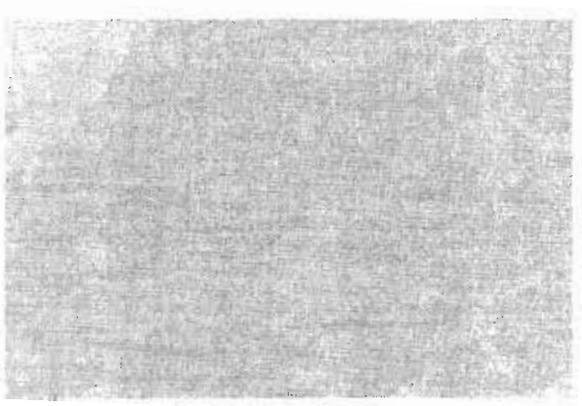

Fig. 8. Section in liver of fish in BZ showing normal architecture of the hepatic lobules, but the central vein was branched and wide sinusoid as well as lymphatic population were observed within the hepatic lobules and the portal lobules. (x 120, H&E stains)

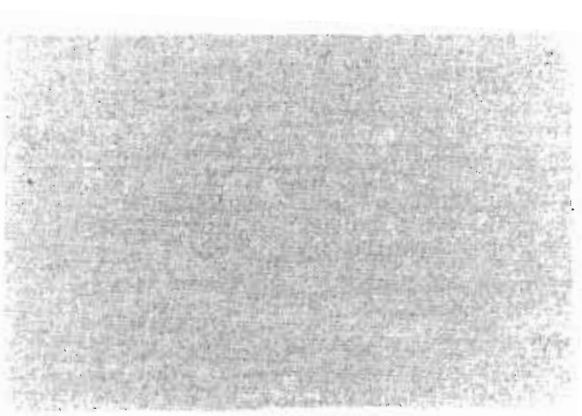

Fig. 9. Section in liver of fish in BZ showing normal architecture of the hepatic lobules, but the central vein was branched and wide sinusoid as well as lymphatic population were observed within the hepatic lobules and the portal lobules. (x 120, H&E stains)

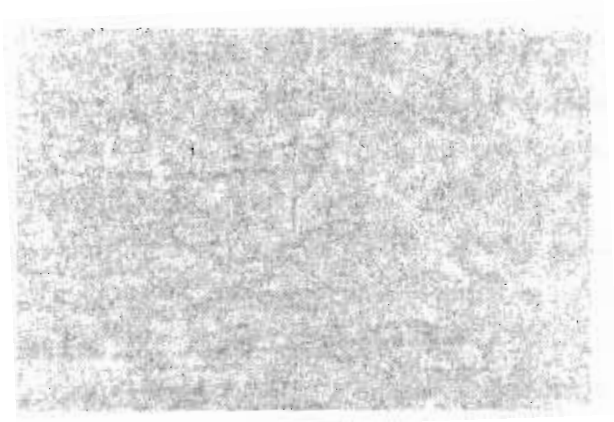

Fig. 10. Section in liver of fish in DY3 showing normal architecture of the hepatic lobules, some vacuoles within the hepatic lobules. (x 150, H&E stains)

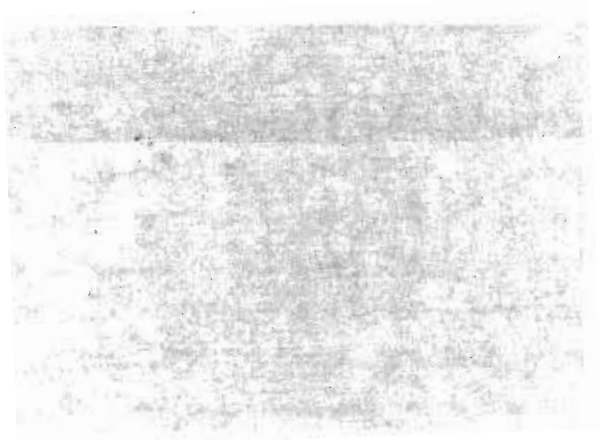

Fig. 11. Section in kidney of fish in BG group showing normal architecture of the renal cortex and intact structure of both glomerulosa and renal tubules, but mild infiltration of fibroblast cells was observed between the renal tubules (x 150, H&E stains).

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بعض الإضافات الغذائية في مستويات مختلفة في عليقه البلطي النيلي

عادل عزت طولان

المعمل المركزي لبحوث الثروة السمكية بالعباسة مركز البحوث الزراعية- جيزة - مصر

تم القيام بهذا العمل لتقيم تأثير بعض الإضافات الغذائية في عليقه بعض البلطي النيلي.وقد استخدمت الأنواع الاتيه:الخميرة ونوعين من البروبيوتيك (الإضافات الحيوية) باسبلوز يم و باسبلوجين وفيتامين ج في ثلاث مستويات علي الحاله الانتاجيه وكفاءة التمثيل الغذائي والهستوباثولوجى للكبد والكلى التركيب الكيماوي لجسم السمك والتحليل الاقتصادىوقد تم استخدام عدد ٣٩٠ إصبعية من نوع بلطي نيلي في ٣٩ حوض زجاجي مقسمة آلي أربع معاملات بالإضافة آلي المعاملة الضابطة وكل معامله مقسمة الى ثلاث مستويات وكل مستوى له ثلاث مكررات وتم تخزين١٠اصعيات في كل حوض وكان العلف المصنع يحتوي علي نسبة ٢٢ % بروتين وقد تم إضافة الخميرة بالنسب آلاتية (٢٠,١٥,١٠ جرام/كيلوجرام علف) باسيلوجين وياسلوزيم (٣,٢,١ جرام /كيلو جرام علف) وفيتامين ج بالنسب آلاتية (٢٠٠٠,١٥٠٠,٥٠٠ ملج / كيلو جرام علف وكانت افضل النتائج فى حالة المعاملة التي استخدم فيها باسلوزيم بنسبة ٣ ج /كيلوجرام علف دون اى ظهور لاي صورة مرضية في الدم او للفحص الهستوباثولوجى وكذلك بالنسبة للخميرة ٢٠جم /لكل كيلوجرام علف وكانت أسوء النتائج التي تم تسجيلها في حالة فيتامين جـ ٢٠٠٠ ملج /كيلوجرام علف.